

Detecting and Avoiding Nematode Problems

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Plant parasitic nematodes are microscopic roundworms that live in soil and feed on roots or foliage of economically important plants. Nematode feeding can result in diseased plants with symptoms such as stunting, yellowing, wilting, yield reduction, root galling and the formation of root lesions. Although damage from plant parasitic nematodes costs Michigan growers millions of dollars annually, many of these losses are never correctly diagnosed. This bulletin provides instructions for the nematode detection methods necessary to avoid or diagnose nematode problems.

A laboratory analysis of soil and root or shoot system tissue is usually necessary for diagnosis or long-term avoidance of plant-parasitic nematode problems. In Michigan, this service is provided by the Michigan State University Nematode Diagnostic Service Laboratory, operated under the direction of the Michigan Cooperative Extension Service. There are also a number of private sector laboratories that provide nematode detection services. A \$10 fee is charged by MSU for analyzing each combined soil and root or individual sample. Nine dollars per sample is charged for lots of 20 to 49 samples, and \$8.00 per sample for 50 or more samples. Pre-payment is desired. A fee of \$5.00 is charged for all billings. However, growers, pest management organizations, corporations, and researchers can contract with the MSU Nematode Advisory Service Laboratory for billings on a monthly or quarterly basis.

Samples for nematode analysis should be forwarded to the:

Nematode Advisory Service Laboratory
Department of Entomology
Michigan State University
East Lansing, Michigan 48824

Samples taken directly to MSU should be delivered to Room 35 in the basement of the Natural Science Building. All samples must be submitted with a completed nematode sample information form (Fig.1). These forms are available at county Cooperative Extension Service offices.

Sample objective

The results from the samples are used to decide how to deal with nematode problems and how to avoid problems.

Diagnosing problems

When plants exhibit symptoms such as stunting, yellowing, wilting, early-die, yield reduction, root-galling, root-lesions or plant mortality that cannot be attributed to other causes, take samples of appropriate soil, root system, or shoot system, and submit them for nematode analysis.

Avoiding nematode problems

Generally soil from Michigan agricultural sites should be analyzed for nematodes every 3-5 years. The test results are used to make decisions for avoiding nematode problems.

Figure 1. Nematode sample form properly completed for a future peach orchard site.

MICHIGAN COOPERATIVE EXTENSION SERVICE
MICHIGAN STATE UNIVERSITY, EAST LANSING, MICHIGAN 48824
AND U.S. DEPARTMENT OF AGRICULTURE COOPERATING

NEMATODE ADVISORY SERVICE SAMPLE SUBMISSION FORM

Name Sam Smith Present Crop/Plant Sudax
 Address RR2 County Road 3 Variety M-42
Fruitville Zip 43958 Planting Date 5 May 89
 County Burke Township Monroe Future Crop 19 91 : Peach
 Section 16 Sample Date 20 Aug 89 Past Crops 19 68 : Plum
 Sample/Field I.D. Orchard No. 18 19 18 : Sweet Cherry
 Soil Type McBay Sandy Loam Nematicide Use Nemacur 1983
(Name and Treatment Date)

SAMPLE METHOD (check) : As described in MSU Ext. Bull. E-800 Other (describe)

REASON FOR SAMPLE (check): Problem Avoidance/IPM Problem Diagnosis

TYPE OF ANALYSIS REQUESTED
 Soil and root analysis for root-feeding nematodes (\$10, \$9 or \$8/sample)^{1,2}
 Foliar nematode analysis (\$10, \$9, or \$8/sample)^{1,2}
 Verticillium dahliae analysis for potato soil (\$5/sample).²
 Soybean cyst nematode race determination (\$15/field).²

DISEASE SYMPTOMS

Above Ground Symptoms	% of Plants in Field with Symptoms	Distribution (check):
Yellowing	40	Entire Planting <input type="checkbox"/> Localized <input checked="" type="checkbox"/> Scattered <input type="checkbox"/>
Necrosis		
Stunting	40	
Wilting		
Other <u>low yields</u>		

Below Ground Symptoms (check): Galls
 Excessive branching
 Rot
 Reduced Growth

COMMENTS:
 Previous plum orchard had a root-lesion, dagger and ring nematode problem. Objective of this sample is to determine what additional action is needed before planting a peach orchard in 1991.

Return Results to Sam Smith, Consultants
 Address RR2
Fruitville, MI County Burke
 Zip 43958

¹\$10/sample for 0-19 samples, \$9/sample for 20-49 samples, \$8.00/sample for > 50 samples.
²A billing charge of \$5 will be added for all sample lots or quarterly contracts not paid at the time of sample submission.

No. of samples 4 Amount enclosed \$ 40.00

DO NOT WRITE BELOW THIS LINE

Number of samples received 1 Date Received 25 Aug 89 Revised 1988
 Samples number(s): 43067 Amount Received \$ 0.00

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Figure 2. Nematode sampling in root zone.

When to sample

Generally, soil and root samples can be taken, submitted and reliably processed whenever the soil is not frozen. For the best possible results, however, do not take samples until 45 days after annual root growth, and not after the soil is frozen in late fall or winter.

When considering fall soil fumigation or spring nematicide application, take and submit samples between the end of July and early September.

How to sample

Sampling instrument: Take samples with a solid sampling tube, trowel, or narrow-bladed shovel at a 2- to 12-inch depth. Include as many feeder roots as possible (Fig.2).

Feeder roots or shoot tissue must always be included for samples submitted for recovering endoparasitic nematodes.

Sample size: Each sample should consist of a pint to a quart of soil taken from a larger sample composed of 10 or more subsamples (Fig. 3). The number of samples needed depends on the size, history, and uniform soil texture of the area being investigated (Figs. 4-6).

- Small area (less than 5,000 sq. ft.), take at least 10 subsamples (soil cores or borings). Recommended sampling schemes are illustrated in Figs. 7-10.



Figure 3. Ten or more soil cores or borings should be submitted with each sample.

- Medium area (5,000 sq. ft. to 1 acre), take at least 25 subsamples.
- Large area (1 to 80 acres), take at least 50 subsamples. In Michigan, no one sample should represent more than 80 acres, and each sample should be from an area of uniform soil texture.

The sampling pattern depends on the commodity and field history. Mix subsamples in a clean pail or a plastic bag and submit one pint to a quart for nematode analysis. This is basically a common sense approach to sampling, as indicated in Figs. 4-10.

Subsamples from problem area: Plant-parasitic nematodes feed only on living tissues and are rarely found in dead root samples. Therefore, take samples from the margin of the problem areas where the plants are still living.

For diagnosis of the pinewilt disease and other foliar diseases of ornamentals, shoot system tissue is required. Additional details about sampling for the pinewood nematode are in MSU Extension Bulletin E-1682.

Sampling container: Either the special nematode sampling container provided by Extension or a plastic bag can be used for nematode samples. Place samples in plastic bags as soon as possible. Nematodes will be killed if the sample is allowed to dry, and it is important that nematodes are living when the sample arrives at the laboratory.

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Figures 4 – 6. Number of samples required.

Figure 4. Two samples required/160 acres.

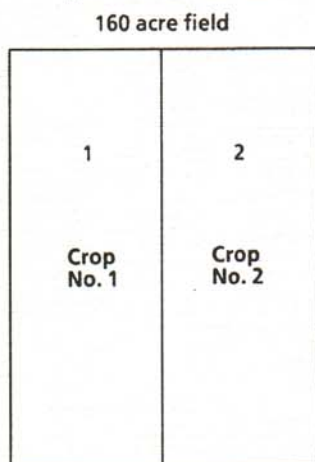


Figure 5. Four samples required/160 acres.

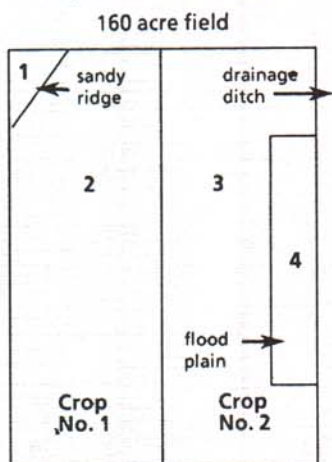
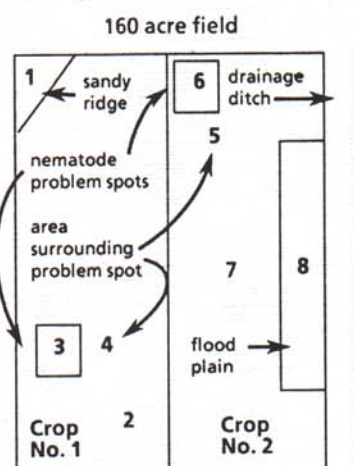


Figure 6. Eight samples required/160 acres.



Figures 7 – 10. Nematode subsample field patterns

Figure 7. Fallow fields or areas planted in a cover crop.

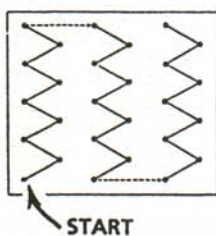


Figure 8. Orchard

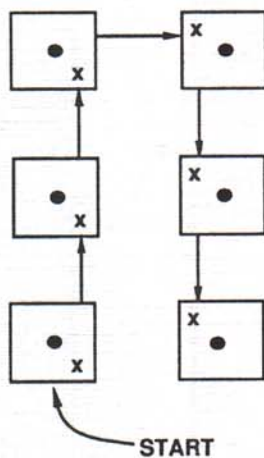


Figure 9. Row crops (take samples from feeder root zone).

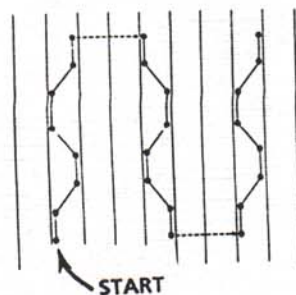


Figure 10. Individual tree.

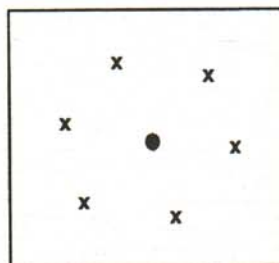


Figure 11. Nematode sample results form for a soybean cyst nematode problem site.

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NEMATODE ADVISORY SERVICE REPORT

Name Mike Jones Date Processed 27 Aug 89
 Sample Number 43072 Nematode Analysis Method C S BA
 VA SCNRD OA
 Date Received 26 Aug 89 Sample Condition Good

PLANT PARASITIC NEMATODES, POPULATION AND THRESHOLD

Nematode	Population		Risk Index ³
	Soil ¹	Root ²	
Root-lesion <input checked="" type="checkbox"/> Penetrans <input type="checkbox"/> _____	5	12	1
False root-lesion			
Root-knot <input type="checkbox"/> Northern <input type="checkbox"/> _____			
Cyst <input checked="" type="checkbox"/> Soybean <input type="checkbox"/> Oat <input type="checkbox"/> Sugarbeet <input type="checkbox"/> Clover	72 cysts	312 J2s	5
Pinewood			
Stubby-root		●	
Dagger		●	
Needle		●	
Stunt		●	
Lance	2	1	1
Sheath		●	
Ring	48	●	0
Pin		●	
Spiral		●	
Foliar			
Other			
Other			

OCCURRENCE OF BENEFICIAL NEMATODES

Saprophagous Nematodes CM
 Predaceous Nematodes FW
 Endomycorrhizal Fungi CM
 Nematode Trapping Fungi NN
 NN = none AB = abundant
 FW = few EX = extreme
 CM = common

DIAGNOSIS:

Nematode problem site
 Disease complex problem site
 Possible problem site
 Future problem site
 Possible future problem site
 No problem detected

GENERAL RECOMMENDATION:

Action advisable
 Employ tactic on a trial basis
 Refer to MSU Ext. Bulletin No. 1582 pages 46-47
 _____ pages _____
 No action strategy available
 Submit root sample _____
 Submit addition soil sample before next soybean crop.
 No action required at this time

SPECIFIC RECOMMENDATIONS/COMMENTS:

- Soybean cyst nematode problem.
- Crop rotation recommended (corn, potatoes, wheat, pickles)
- Do not rotate with drybeans
- Resample before next soybean crop.
- Soybean cyst nematode nematicides in E-1582.
- Soybean cyst nematode race determination optional.

¹Nematodes /100 cm³ soil

²Nematodes /1.0 g root

³Risk Index

- 0 = None Detected
 1 = Low
 2-3 = Moderate
 4 = High
 5 = Severe

Sample Fee \$ 10.00

Billing Fee \$ 5.00

Amount Billed \$ 15.00

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MSU Extension Nematologist

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Sample storage: Soil and root samples should be regarded as perishable. Handle accordingly, and process as quickly as possible. Ideally, they should be stored at 10-15 C (50-58 F). Do not expose them to direct sunlight or store them in hot areas, such as the trunk of your car. Temperatures greater than 40 C (100 F) will kill nematodes.

How to submit samples

Samples are usually submitted to the MSU Nematology Laboratory through the local extension office, accompanied by a completed form (Fig. 1). The information requested on the form is essential for diagnosing nematode problems and proper recommendations for nematode population management.

It generally takes two weeks from the time a sample is taken until the results are returned to the grower. The results may be returned through the local extension agent, a private consultant, or directly. The rapid root and soil assays used for mineral soils, however, are not always satisfactory for analysis of organic soils. In a few cases, a bioassay that requires a 45-day incubation period is used to analyze organic soils. When this procedure is recommended, the grower will be immediately notified of the delay and will receive the results within two months after the sample was received.

Results and recommendations:

Sample results and recommendations are usually returned through the local extension agent. The types

and numbers of nematodes will be recorded on the assay form along with an indication of whether or not nematodes are a problem (Fig. 11). If nematodes appear to be a problem, you will be referred to an appropriate extension bulletin for a recommendation. The recommendation should be discussed in detail with the local extension agent or private consultant

Post-treatment samples

One way to analyze the success of nematode population management is to submit a post-treatment sample for nematode analysis. These samples should be taken four to six weeks after treatment. It is important that the original forms be completed so the post-treatment results can be compared with those of the original.

Other analyses

The MSU Nematode Advisory Service processes soil and tissue samples from potato and mint production sites for *Verticillium dahliae* (\$5.00/sample) and soil samples for soybean cyst nematode race determination (\$15/sample). The *Verticillium* analysis sample takes 30 days, and the soybean cyst nematode race determination takes 45 days.

Additional information

Extension bulletins on the control of nematodes that damage fruit, vegetable, field and ornamental crops are available at county extension offices or by writing: MSU Bulletin Office, Room 10B Agriculture Hall, East Lansing, Michigan 48824-1039.

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